An Evaluation of Region 2 Wipe Sampling Data from the 2002 EPA Cleanup Program

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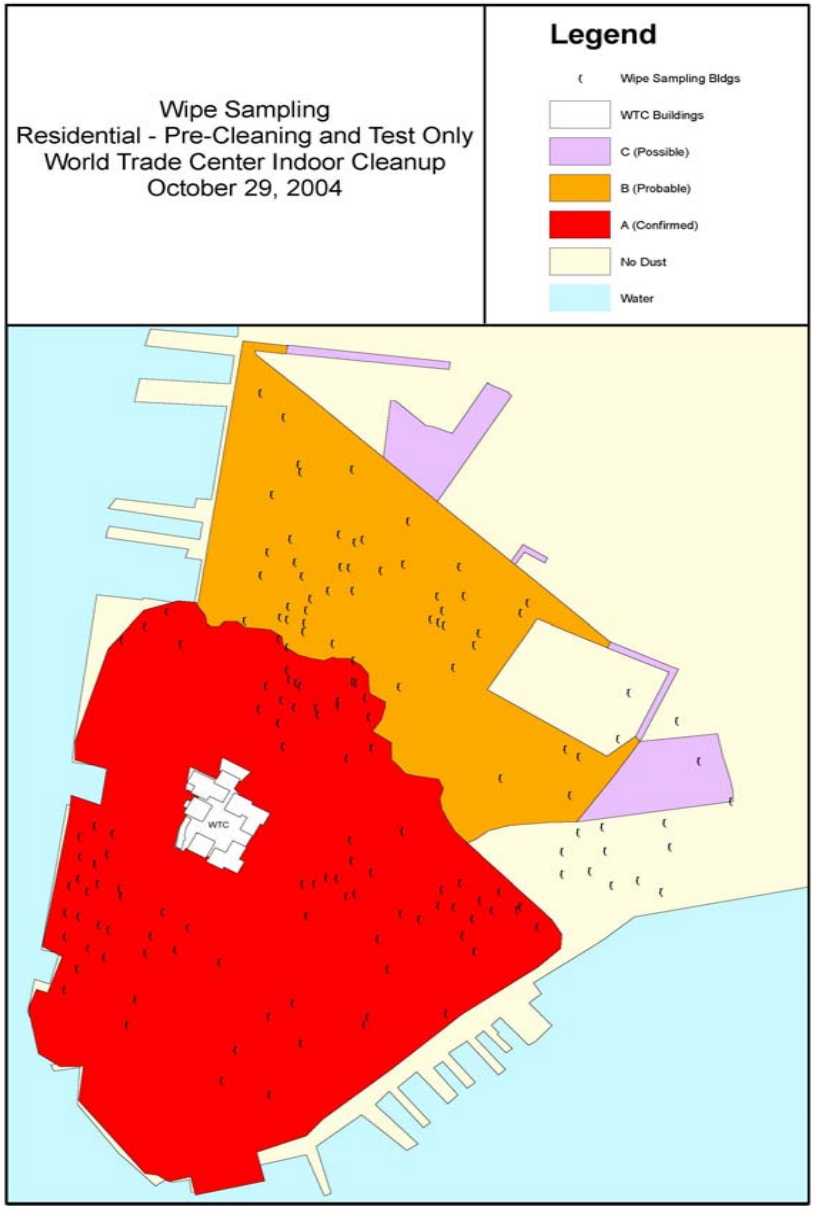
Background

- During the 2002 Region 2 Cleanup Program, over 1500 pre- and post-cleaning wipe samples were taken in 263 (of 4200) apartments in 165 buildings. These were measured for 24 contaminants, including lead and other metals, and dioxin.
- Wide geographic coverage was sought by attempting to identify volunteers in as many buildings as possible.
- This evaluation focuses on the approximate 1000 pre-cleaning sample results, with an emphasis on lead.



Location of Sampled Apartments With Respect to EPIC Zones of Confirmed (Red), Probable (Orange), Possible (Pink), and No (Beige) Impact by Dust and Debris from the Collapse of the WTC Towers

Building Construction Year by Zone

Date built	n	Zone A	B	C	D
Before 1920	60	37	22	1	0
1920 - 1950	13	0	11	0	2
After 1950	25	19	6	0	0
No date	58	35	10	1	12

Notes:
A = confirmed dust;
B = probable;
C = possible;
D = no dust

Overview of Key Results

Cont.	N	Health-based benchmark	# > BM; (range)	Overall Mean
Mercury	915	157 µg/m^2	5 (161-248)	4
Dioxin	859	2 ng/m^2	6 (2 – 5; 75)	0.8
Lead	995	25 ug/ft^2	115(25 – 6790)	37
Lead *	993	25 ug/ft^2	113(25 – 1380)	22

Notes:

* These are lead results not including two high outliers at 6790 and 2530 µg/ft^2

- N is number of total samples; about 4 samples per apartment.
- 1 or 2 exceedances found for 20 other contaminants
- the high measurement of dioxin of 75 ng/m^2 was found above a fireplace.

Lead Analyses

- Lead results show that 12% of the measurements exceed the health-based benchmark. The results will be examined as a function of three factors that may affect measured lead concentrations:
  - Location: EPIC Zone & distance from Ground Zero
  - Age of building
  - Floor of building where measurement is taken
- Also, the proposed criteria for building cleanup includes a link to WTC dust via signature analysis and 95% upper confidence limit on the building mean to be greater than the 25 $\mu g/ft^2$ benchmark. How many buildings would meet this concentration criteria?

Lead Results by EPIC Zone

	Zone				
	A	A^1	B	C	D
N	625	623	285	7	78
Mean, µg/ft^2	37	22	21	26	14
Median, µg/ft^2	7	7	2	17	9
Max, µg/ft^2	6790	1380	1160	48	208

Notes:

A = confirmed dust;

A^1 = confirmed with two high measurements of 2530 and 6790 µg/ft^2 deleted;

B = probable;

C = possible;

D = no dust

Lead Results by Distance from WTC

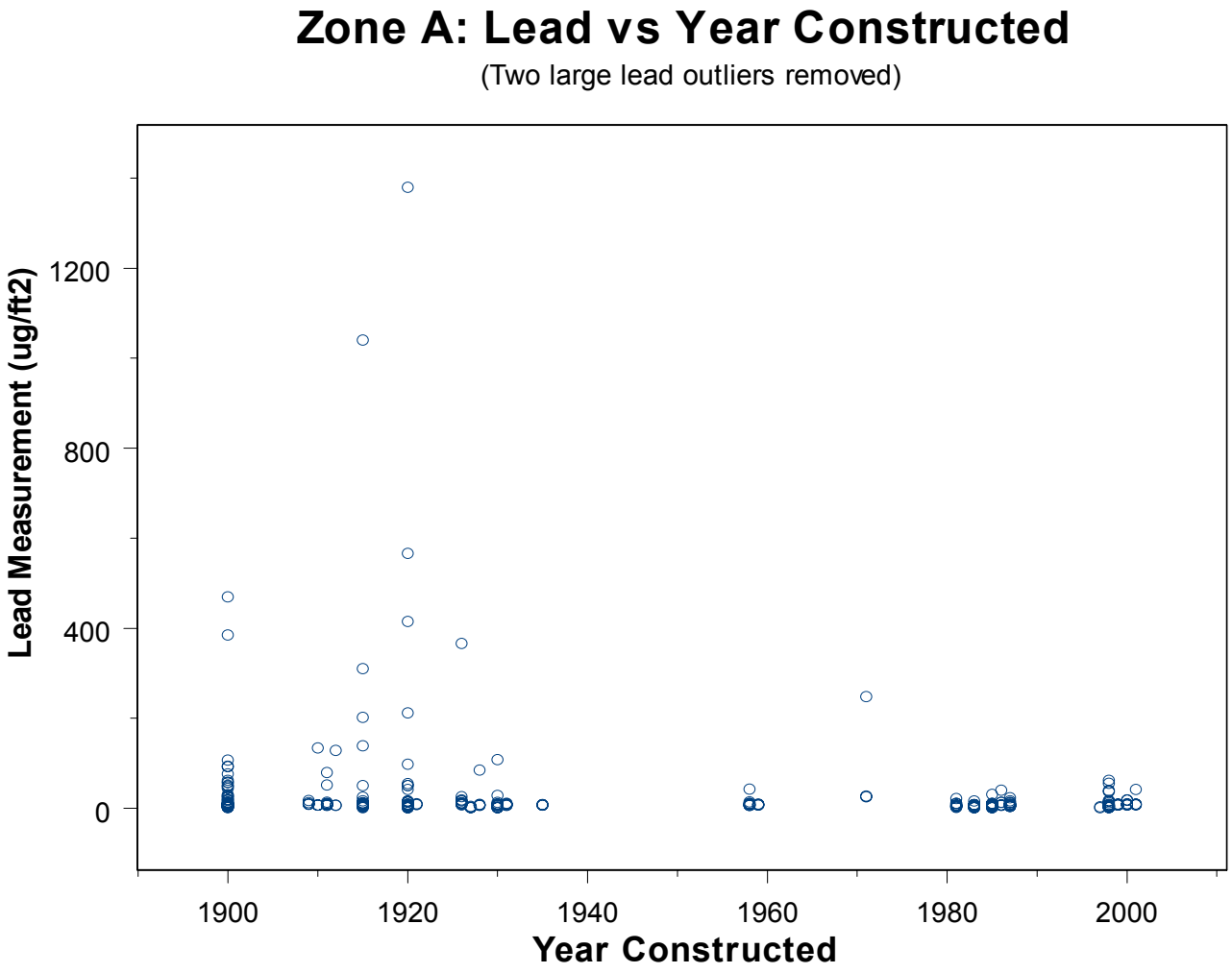
Meters	0-250	250-500	500-750	750-1000	>1000
N	102	388	276	145	82
Mean, μg/ft^2	20	29 (23)*	23	66 (18)**	20
Median, μg/ft^2	7	7	6	4	9
Max, μg/ft^2	861	2530	1160	6790	208

Notes:

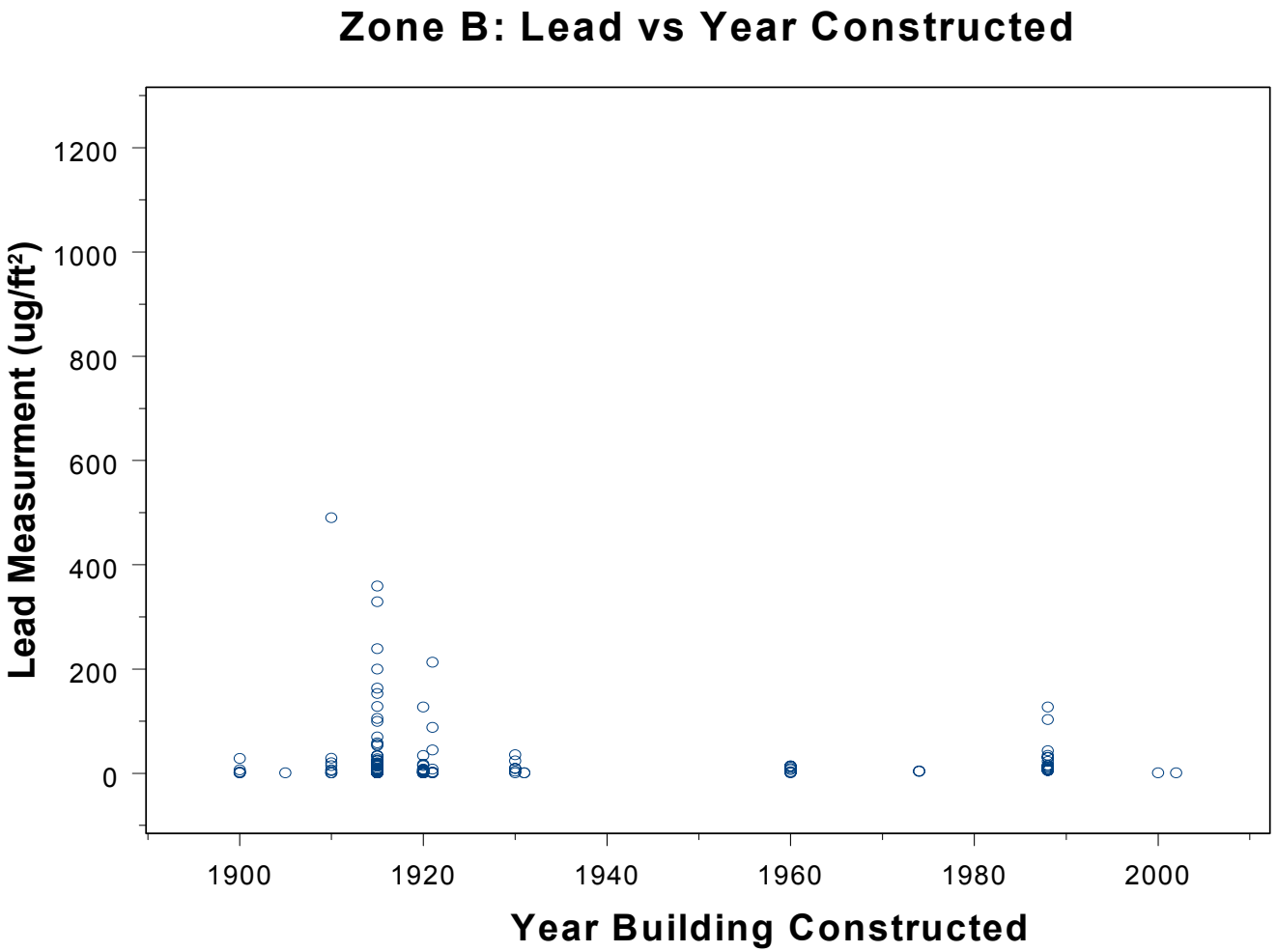
* mean for 250-500 with outlier of 2530 removed

** mean for 750-1000 with outlier of 6790 removed

Results by Building Age



Results by Building Age



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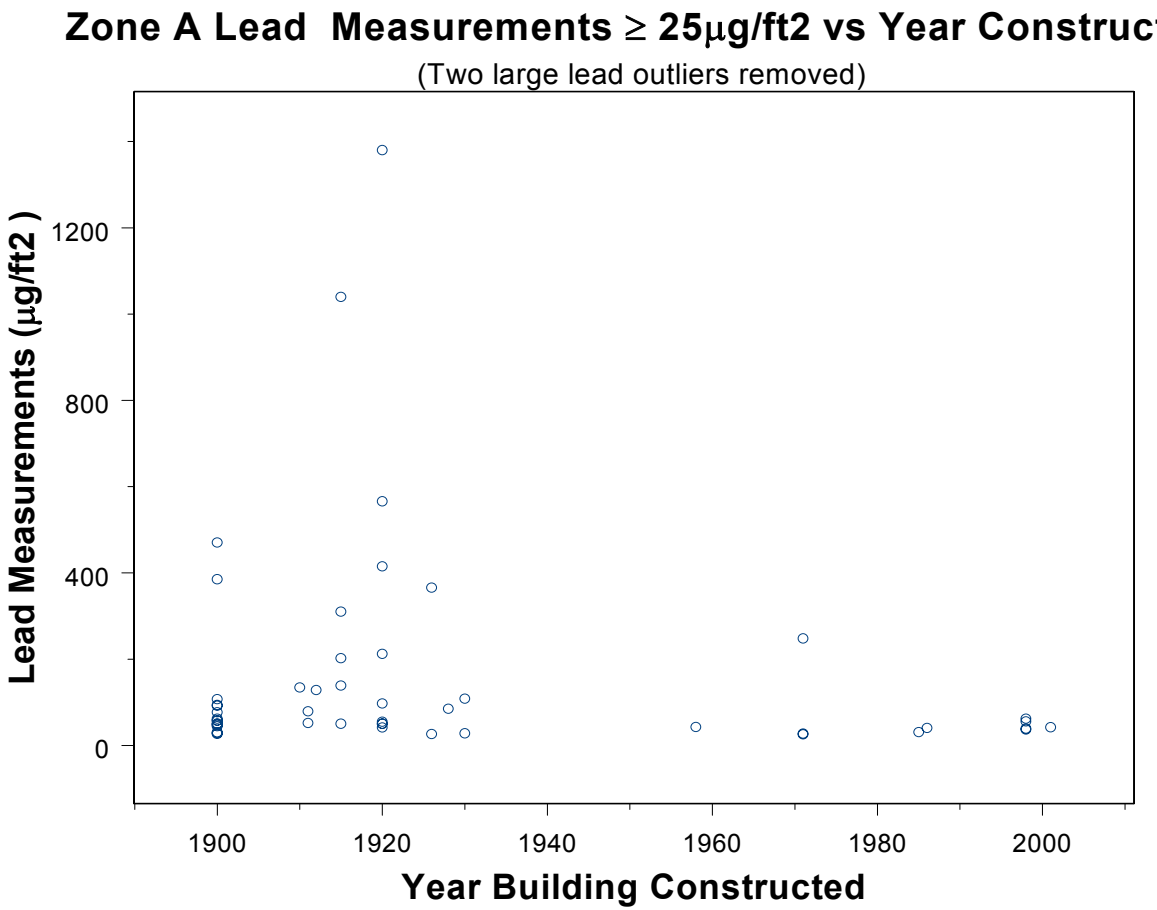

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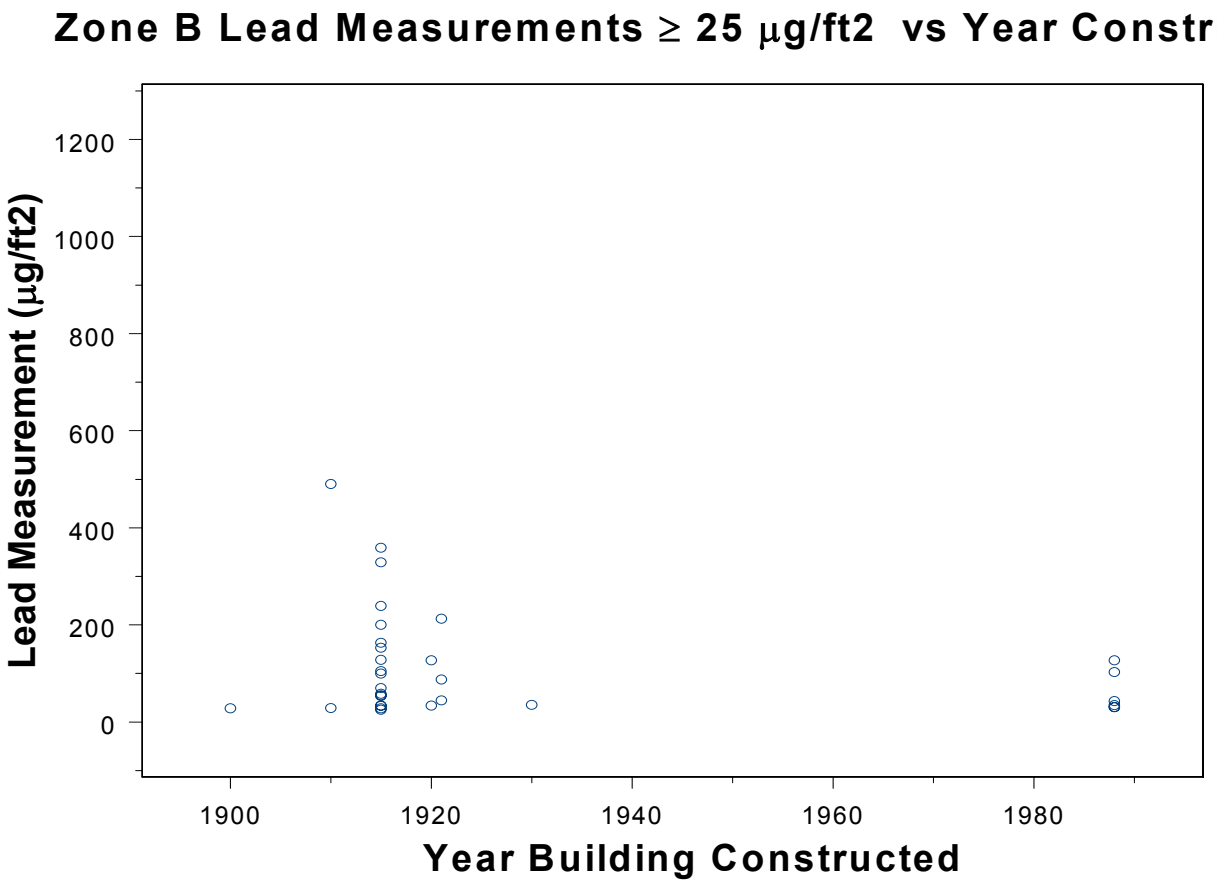

Means ($\mu g/ft^2$) by Floor & EPIC Zone

Floor	Overall Mean (n)	Zone A	Zone A^1	Zone B	Zone C	Zone D
Basement	113 (4)	---	---	113	---	---
1st	14 (29)	5	5	26	---	---
2nd	117 (124)	168	56	9	---	9
3rd	29 (127)	38	38	42	24	6
4th	21 (114)	10	10	36	23	13
5th	25 (80)	12	12	80	---	2
6 – 10	14 (227)	13	13	12	---	22
11 – 20	21 (141)	29	29	11	---	10
>20	8 (149)	6	6	5	---	7

Notes:

All results are the mean in $\mu g/ft^2$

Means above 25 $\mu g/ft^2$ highlighted

A^1: Zone A mean for 2nd floor measurements calculated without two outliers[13]

Means ($\mu g/ft^2$) by Floor & Year Built

Floor	Overall Mean (n)	Year ≤1920	1921-50	>1950	No Year
Basement	113 (4)	113	---	---	---
1st	14 (29)	19	---	2	5
2nd	117 (124)	204 (41)[1]	34	9	8
3rd	29 (127)	53	15	5	16
4th	21 (114)	35	24	7	10
5th	25 (80)	14	7	10	45
6 – 10	14 (227)	17	4	14	14
11 – 20	21 (141)	31	1	14	25
>20	8 (149)	39	17	6	5

Notes:

[1]mean of 41 calculated with two outliers of 6790 and 2530 µg/ft² removed

All results are the mean in µg/ft²;

Means above 25 µg/ft² highlighted

Observations on Full Data Set

- When the two lead outliers are deleted, the overall results do not appear meaningfully different among the four zones, and among the five distance categories.
- There is a suggestion that higher concentrations are found on lower building floors, across zones
- The clearest relationship is between lead concentrations and age of building, i.e., older buildings tend to have the higher concentrations
- Some high lead concentrations were also observed in newer buildings

Highest Lead Measurements

- An examination of the highest measurements for lead may suggest trends of note. There are 23 measurements higher than 200 µg/ft^2:
  - 15 of these 23 measurements are in “confirmed” zone; only 1 in “no dust” zone
  - 17 of the top 23 measurements are found in the 5th floor or lower
  - 18 of top 23 are in buildings built 1926 and earlier; 4 have no date and 1 built in 1971.
  - 11 of top 13 are in “confirmed” zone, but 9 of these 13 are in buildings built 1920 and earlier, with the remaining 4 in buildings of unknown age.
- Taken together, this suggests that all three factors (zone, floor and age) may be related to the observation of the highest measurements of lead in this sampling program.

Highest Lead Measurements

- Site specific factors may help to explain results from particular buildings. For example:
  - High measurements were made in three buildings on Chambers St that were located near a renovation project.
  - High measurements were made in a building on Liberty Street that was also observed to have remaining WTC dust lodged outside in window ledges.
  - The building with the highest measurement, 6790 $\mu g/ft^2$, was built in 1900, the earliest year identified for building date in this sample set. (However, this measurement may be suspect because it is so much larger than the others.)

Building-Specific Results by EPIC Zone

Description	Zone A	B	C	D
Number buildings	91	49	2	17
# blds mean > 25	18	10	1	0
# blds 95% UCL > 25	32	17	2	4
# blds max > 25	42	18	2	3

Notes:

A = confirmed dust; B = probable; C = possible; D = no dust

blds mean > 25 : # of buildings with mean > 25 µg/ft^2

blds 95% UCL > 25: # of buildings with 95% UCL on mean > 25 µg/ft^2

blds max > 25: # of buildings with maximum observed value > 25 µg/ft^2

Overall Results

- Measurements of contaminants above health benchmarks were infrequent with the exception of lead
- The clearest relationship is found between lead concentrations and age of building, suggesting lead paint as a cause for high lead measurements in Lower Manhattan.
- Proximity and floor of building seemed to be, at best, weakly related to measured lead levels. However, an examination of the highest measurements does suggest that, on a case-by-case basis, these factors as well as direct WTC impact, may be important.
- Building-specific results suggest that a substantial percentage of buildings may meet the partial criteria for building cleanup of 95% UCL of mean being greater than health benchmark of 25 $\mu g/ft^2$.